



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>6</sup> : H01H 23/00	A1	(11) International Publication Number: WO 99/05691	(43) International Publication Date: 4 February 1999 (04.02.99)
---	----	--	---

(21) International Application Number: PCT/US98/14094

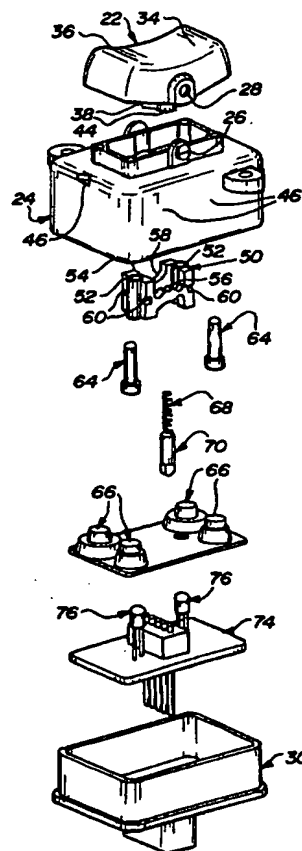
(22) International Filing Date: 8 July 1998 (08.07.98)

(30) Priority Data:  
08/898,137 22 July 1997 (22.07.97) US(71) Applicant: UT AUTOMOTIVE DEARBORN, INC. [US/US];  
5200 Auto Club Drive, Dearborn, MI 48126-2659 (US).(72) Inventor: KARASIK, Boris; 450 Woodland Hills Drive,  
Walled Lake, MI 48390 (US).(74) Agents: CARLSON, John, E. et al.; Howard & Howard  
Attorneys, P.C., Suite 101, 1400 North Woodward Avenue,  
Bloomfield Hills, MI 48304 (US).(81) Designated States: CA, JP, European patent (AT, BE, CH, CY,  
DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT,  
SE).**Published**  
*With international search report.*

(54) Title: UNIVERSAL SWITCH

## (57) Abstract

A user-activated switch assembly includes a knob pivotally mounted in a housing. A plunger is selectably mountable in any one of a plurality of locations between the knob and a cam. The cam includes a plurality of cam surfaces, any one of which can be selected based upon the orientation of the cam and/or the location of the plunger.



**FOR THE PURPOSES OF INFORMATION ONLY**

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav	TM	Turkmenistan
BF	Burkina Faso	GR	Greece		Republic of Macedonia	TR	Turkey
BG	Bulgaria	HU	Hungary	ML	Mali	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MN	Mongolia	UA	Ukraine
BR	Brazil	IL	Israel	MR	Mauritania	UG	Uganda
BY	Belarus	IS	Iceland	MW	Malawi	US	United States of America
CA	Canada	IT	Italy	MX	Mexico	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NE	Niger	VN	Viet Nam
CG	Congo	KE	Kenya	NL	Netherlands	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NO	Norway	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's	NZ	New Zealand		
CM	Cameroon		Republic of Korea	PL	Poland		
CN	China	KR	Republic of Korea	PT	Portugal		
CU	Cuba	KZ	Kazakstan	RO	Romania		
CZ	Czech Republic	LC	Saint Lucia	RU	Russian Federation		
DE	Germany	LI	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

## UNIVERSAL SWITCH

### BACKGROUND OF THE INVENTION

5           The present invention relates generally to a user-activated switch and more particularly to a user-activated switch assembly which can be assembled in different configurations to provide any one of a plurality of switch camming features.

10           Current switch assemblies generally comprise a rocker knob pivotally mounted to a housing and pivotally moveable, typically among three positions, from a neutral center position to either a rearward position or a forward position. A first set of contacts are closed when the knob is in the forward position and a second set of contacts are closed when the knob is in the rearward position. Typically, one of a plurality of known return features are  
15           provided. For example, the knob may be provided with appropriate hardware to provide a spring return from either the forward position or rearward position to the neutral position or to latch the switch in either the forward or rearward position until selectively moved to the other position. Further, combinations of these known return functions can be provided, such that the  
20           knob will automatically return from the forward position to the neutral position but latch when moved to the rearward position or vice versa.

          In order to provide each of the desired return features, a separate set of hardware is required to be assembled into the switch assembly. This increases tooling costs for the hardware, the amount of inventory which must  
25           be maintained, the assembly time required to select, retrieve and install the proper hardware and the overall cost.

### SUMMARY OF THE INVENTION

The present invention provides a universal switch assembly which, by being assembled in one of a plurality of configurations, provides one of a plurality of available return features. The switch assembly generally comprises a rocker-type knob, selectably pivotable among a forward position, a neutral position and a rearward position in a housing. A plurality of different cam surfaces each having a different cam profile are provided in the housing. A plunger is mounted between the knob and one of the cam surfaces in the housing. One of the cam surfaces is selected in one of two ways. First, the plunger may be mounted in one of a plurality of locations relative to the knob, such that it is adjacent either the first cam surface or the second cam surface. Second, the cam surfaces may be positioned and oriented in different positions such that the selected one is adjacent the plunger. In this manner, a selected one of a plurality of available cam profiles can be provided to the knob.

Preferably, the plurality of cam surfaces are provided on a cam. A first cam surface is mounted along a first lateral side of the cam, while the second cam surface is mounted along a second lateral side of the cam. The cam can then be mounted in the housing in one of two orientations in order to locate a selected one of either the first cam surface or second cam surface adjacent the plunger.

Most preferably, the cam is also provided with a third cam surface and fourth cam surface on an opposite face of the cam to the first and second cam surfaces, respectively. Thus, any of the cam surfaces can be mounted adjacent the plunger.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

The above, as well as other advantages of the present invention, will become readily apparent to those skilled in the art from the following detailed description of a preferred embodiment when considered in the light of the accompanying drawings in which:

Figure 1 is a perspective view of the switch assembly of the present invention;

Figure 2 is an exploded view of the switch assembly of Figure 1;

Figure 3 is a perspective view of the cam of Figure 2; and

Figure 4 is a perspective view of the cam of Figure 3, rotated 180 degrees.

### **DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT**

A switch assembly 20 according to the present invention as shown in Figure 1. A rocker-style knob 22 is pivotally mounted on an upper housing 24. Preferably, pivot pins 26 in the upper housing 24 are snap-fit into apertures 28 in the knob 22 to form a pivot axis. The knob 22 and upper housing 24 are mounted onto a lower housing 30. The knob 22 includes a forward surface 34 forward of the pivot pins 26 and a rearward surface 36 rearwardly of the pivot pins 26 and apertures 28. Typically, a first electrical function is activated when a user presses the forward surface 34, thereby causing the knob 22 to pivot forwardly and a second electrical function is activated when a user presses the rearward surface 36, causing the knob 22 to pivot rearwardly. Of course, the terms "forward" and "rearward" are utilized herein only for convenience. It should be apparent that the switch assembly 20 could be mounted in any orientation.

An exploded view of the switch assembly 20 is shown in Figure 2. As can be seen in Figure 2, the knob 22 includes a pair of laterally spaced cylindrical sleeves 38 extending downwardly, generally perpendicular to the

axis defined by the apertures 28. The upper housing 24 includes an upper orifice 44 leading into the upper housing 24. A plurality of tabs 46, preferably four, (three shown) extend inwardly from the housing 30.

5 The switch assembly further includes a cam 50 having a pair of cylindrical passages 52, one at each axial end. An upper face 54 of the cam 50 includes a first cam surface 56 and a laterally spaced second cam surface 58. A plurality of notches 60 complementary to tabs 46 are disposed about the periphery of the cam 50.

10 A plurality of fingers 64 (two shown) such as are typically utilized in rocker-style switches are adapted to engage the knob 22 below the forward surface 34 and the rearward surface 36. Opposite ends of the fingers 64 are adapted to engage elastomeric switch pad 66 which, as is known, each contain a pair of electrical contacts which are opened or closed by pressure on the elastomeric switch pad 66. A spring 68 is provided for biasing a plunger 70  
15 downwardly. The spring 68 and plunger 70 are selected to fit within cylindrical sleeves 38. The switch assembly 20 further includes a PCB assembly 74 from which a pair of LEDs 76 extend upwardly.

Figure 3 is an enlarged view of the cam 50, showing the upper face 54, which includes the first cam surface 56 and second cam surface 58. It should  
20 be apparent that any cam profiles could be utilized in the plurality of cam surfaces provided on cam 50. Those skilled in the art will recognize the operation of the cam profiles illustrated herein and will know of numerous other cam profiles which could also be utilized with the present invention. The cam surfaces on cam 50 will be briefly described only to illustrate how  
25 different cam surfaces with different cam profiles can be provided to the knob 22 simply by assembling the components of switch assembly 20 in different configurations. As can be seen in Figure 3, the first cam surface 56 includes a forward recess 88 which will latch the plunger 70 (not shown) in the forward position. The first cam surface 56 further includes a neutral recess 90 which  
30 will retain the knob 22 in the neutral position until the knob 22 is pressed. The first cam surface 56 further includes a rearward recess 92 identical to

forward recess 88. The second cam surface 58, on the other hand, is provided with a forward ramp 96, which will always return the plunger 70 from the forward position to the neutral position as soon as pressure on knob 22 is released. Second cam surface 58 further includes a neutral recess 98 retaining knob 22 in the neutral position when no pressure is applied and a rearward ramp 100 identical to forward ramp 96.

The cam 50 further includes a third cam surface 104 on a lower face 106 opposite upper face 54. The third cam surface 104 provides a combination of the features described with respect to first cam surface 56 and second cam surface 58. Third cam surface 104 includes a forward recess 108 providing a latching feature, and a neutral recess 110. Third cam surface 104 further provides a rearward ramp 112, which will always return the plunger 70 from the rearward position to the neutral position when pressure is released. Again, it should be apparent that the terms "forward" and "rearward" are utilized only with respect to the drawings. It is a feature of the present invention that the cam 50 as shown in Figure 4 could be rotated about an axis parallel to cylindrical passages 52, such that "forward" and "rearward" would be interchanged. Although first cam surface 56 and second cam surface 58 are symmetrical, this would provide different features with respect to third cam surface 104, which provides different features for the "forward" and "rearward" positions.

The cam 50 is shown in Figure 4 rotated 180 degrees about an axis parallel to cylindrical passages 52 relative to Figure 3, in order that a fourth cam surface 116 can be shown. The fourth cam surface 116 provides a cam profile providing a double action profile typically utilized to activate a vehicle window lift function. The fourth cam surface 116 provides a neutral recess 118, from which extends a first forward ramp 120, for activating a window manually, and a second forward ramp 122 for activating a window in express mode. A first rearward ramp 124 extends rearwardly from the neutral recess 118. A second rearward ramp 126 extends rearwardly from first rearward ramp 124.

The assembly steps required to selectively provide a selected cam profile to the knob 22 will be described with respect to Figure 2. First, the cam 50 can be installed into the upper housing 24 in any one of four orientations. The cam 50 can be installed with the upper face 54 or lower face 106 oriented toward knob 22. Further, for each of these two orientations, the cam 50 can also be rotated about an axis parallel to cylindrical passages 52, thus providing a total of four available orientations in which cam 50 can be installed into upper housing 24. The cam 50 is installed in upper housing 24 by shapping the tabs 46 into the notches 60. Further, the spring 68 and plunger 70 can be located in either of the two laterally spaced cylindrical sleeves 38, such that the plunger 70 will contact either of the two laterally spaced cam surfaces 56, 58 (or 104, 116). In total, this provides a total of eight possible cam profiles which can be provided to the knob 22. However, in the example shown, some of the cam surfaces are symmetrical and therefore, would not provide different cam profiles in some orientations.

Operation of switch assembly 20 will be described assuming the switch assembly 20 is assembled with the cam 50 oriented as shown in Figure 2 and the spring 68 and plunger 70 located in the knob 22 such that the plunger engages the first cam surface 56. The knob 22 will be provided with a cam profile provided by cam surface 56. As forward surface 34 is pressed, the knob 22 pivots forwardly, thereby causing the plunger 70 to move out of the neutral recess 90 into the rearward recess 92 into which it is latched and causing one of the fingers 64 to depress one of elastomeric switch pads 66 to activate a first electrical function. When the rearward surface 36 of knob 22 is pressed, the knob 22 pivots rearwardly, causing plunger 70 to move out of rearward recess 92 into neutral recess 90. If the rearward surface 36 of knob 22 is further pressed, the knob 22 continues to pivot rearwardly, thereby causing plunger 70 to move out of neutral recess 90 into forward recess 88 and causing one of the fingers 64 to depress one of elastomeric switch pads 66, thereby activating a second electrical function.



It should also be apparent that two springs 68 and plungers 70 could be inserted into both cylindrical sleeves 38 in order to provide multiple cam followers. Multiple elastomeric pads can provide a double pull/double throw switch version.

5           The switch assembly 20 of the present invention thus provides a possibility of eight cam profiles which can be provided to knob 22 all utilizing the same parts. Simply by selecting the location of spring 68 and plunger 70 in either of the cylindrical sleeves 38 and orienting the cam 50 in one of its four orientations, a selected one of eight possible cam profiles can be provided  
10           without the necessity of keeping inventory hardware for each of the eight profiles.

          In accordance with the provisions of the patent statutes, the present invention has been described in what is considered to represent a preferred embodiment. However, it should be noted that the invention can be  
15           practiced otherwise than as specifically illustrated and described without departing from its spirit or scope.

CLAIMS

## WHAT IS CLAIMED IS:

- 5           1.     A user-activated switch assembly comprising:  
            a knob selectively moveable between a first position and a second  
            position on a housing;  
            said housing having a first cam surface having a first cam profile and  
            a second cam surface having a second cam profile different from said first cam  
10           profile;  
            a plunger, said housing and said knob being assemblable in either a  
            first configuration or a second configuration, said plunger contacting said first  
            cam surface in said first configuration and said second cam surface in said  
            second configuration.
- 15           2.     The user-activated switch assembly of Claim 1 wherein said  
            plunger is mountable adjacent said knob in either a first location or a second  
            location.
- 20           3.     The user-activated switch assembly of Claim 2 wherein said  
            plunger contacts said first cam surface when mounted in said first location and  
            said second cam surface when mounted in said second location.
- 25           4.     The user-activated switch assembly of Claim 1 further  
            comprising:  
            a cam having said first cam surface and said second cam surface, said  
            cam being mountable into said housing.
- 30           5.     The user-activated switch assembly of Claim 4 wherein said cam  
            is mountable into said housing in at least two different orientations.

6. The user-activated switch assembly of Claim 5 wherein said plunger contacts said first cam surface when said cam is mounted in a first orientation and said second cam surface when said cam is mounted in a second orientation.

5

7. The user-activated switch assembly of Claim 5 wherein said cam further includes a third cam surface and a fourth cam surface, said first, second, third and fourth cam surfaces each having a different cam profile.

10

8. The user-activated switch assembly of Claim 7 wherein said cam is mountable into said housing in at least four different orientations.

9. A user-activated switch assembly comprising:

15

a knob selectively moveable between a first position and a second position;

a housing having a first cam surface having a first cam profile and a second cam surface having a second cam profile different from said first cam profile;

20

a plunger and said housing being assembled with said plunger biased between said knob and said first cam surface, said plunger moving in contact along said first cam surface while said knob is moved from said first position to said second position.

25

10. The user-activated switch assembly of Claim 9 further including means for mounting said plunger in either a first location adjacent said first cam surface or a second location adjacent said second cam surface, said plunger being mounted adjacent said first cam surface.

30

11. The user-activated switch assembly of Claim 9 further including a cam mounted in said housing, said cam including said first cam surface.

12. The user-activated switch assembly of Claim 11 wherein said cam further includes said second cam surface, said cam being selectively mountable in said housing in a first orientation such that said first cam surface contacts said plunger or a second orientation such that said second cam surface contacts said plunger.

13. A method for assembling a user-activated switch assembly including the steps of:

forming a first cam surface having a first cam profile and a second cam surface having a second cam profile different from said first cam profile in a housing;

mounting a knob in said housing such that said knob is selectively moveable between a first position and a second position;

positioning a cam follower between said knob and one of said first cam surface and said second cam surface, said cam follower being positionable adjacent said first cam surface and a said second cam surface.

14. The method for assembling a user-activated switch assembly of Claim 13 further including the steps of:

selecting between a first location for said cam follower where said cam follower would contact said first cam surface or a second location for said cam follower where said cam follower would contact said second cam surface.

15. The method for assembling a user-activated switch assembly of Claim 13 further including the steps of:

providing a cam having said first cam surface and said second cam surface, said cam being mountable into said housing in at least two different orientations;

selectively orienting said cam in said housing in order to select a surface for said cam follower to contact, said cam follower contacting said

first cam surface in a first orientation and said second cam surface in a second orientation.

16. The method for assembling a user-activated switch assembly of Claim 13 further including the steps of:

moving said knob from said first position to said second position, thereby causing said plunger to move in contact along said selected one of said first cam surface and said second cam surface.

17. A cam for mounting in a user-activated switch having a cam follower, said cam comprising:

a first cam surface having a first cam profile;

a second cam surface having a second cam profile different from said first cam profile;

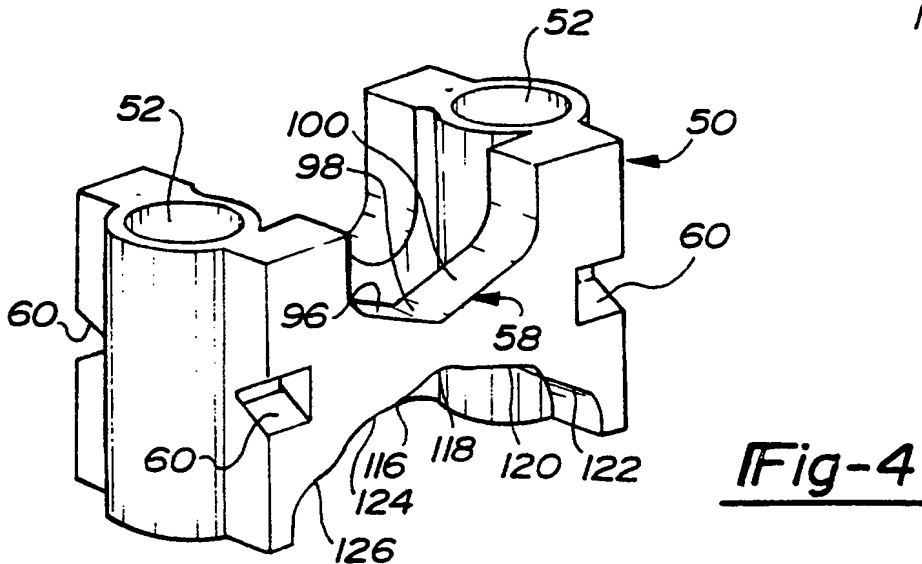
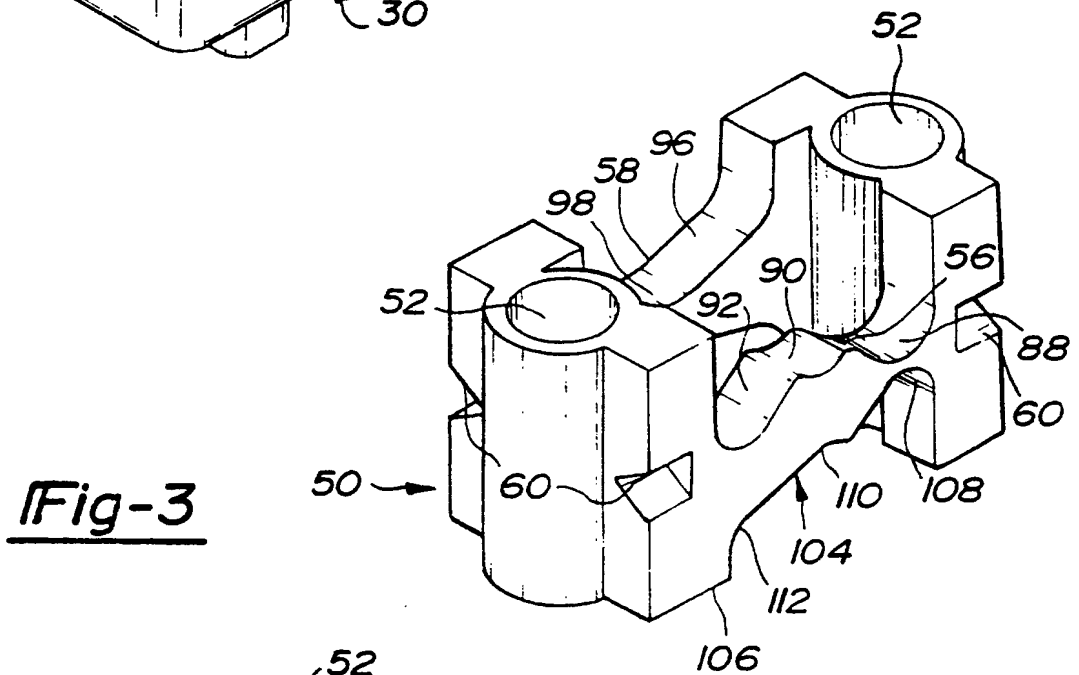
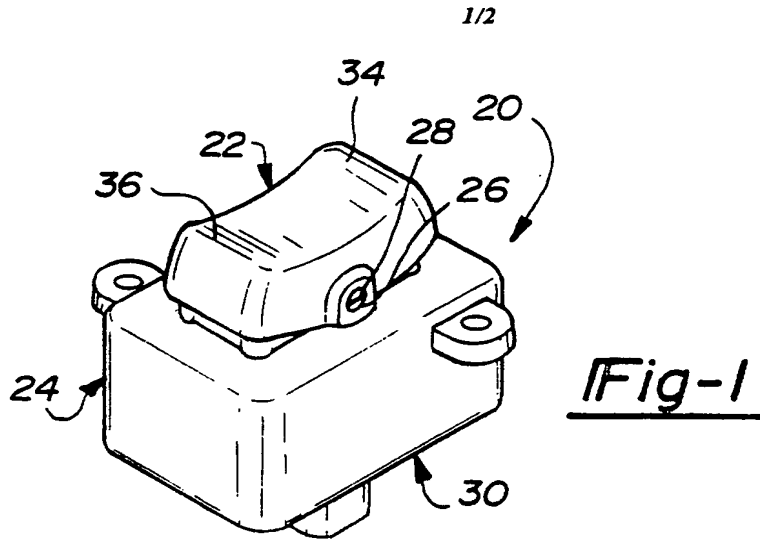
said cam being mountable in a first orientation to select said first cam surface or a second orientation to select said second cam surface.

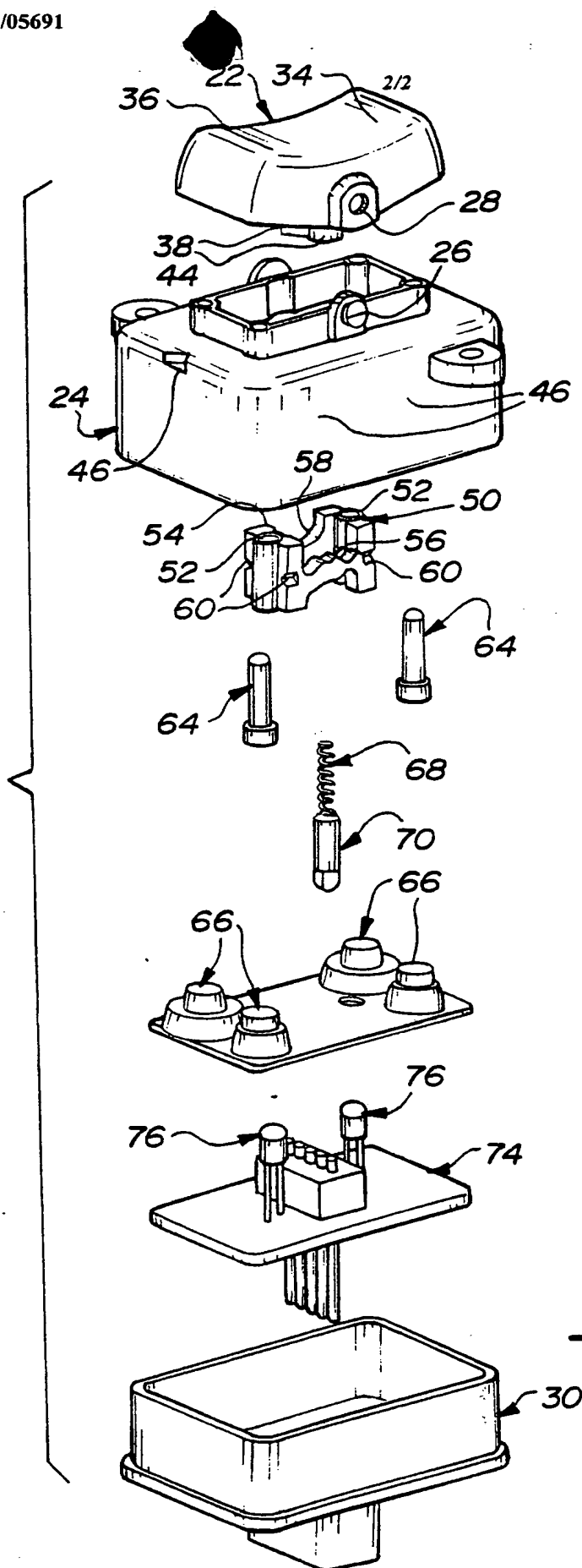
18. The cam of Claim 17 wherein said first cam surface and said second cam surface are formed on opposite faces of said cam.

19. The cam of Claim 17 wherein said first cam surface and said second cam surface are formed generally on a first face of said cam, said first cam surface being laterally spaced from said second cam surface.

20. The cam of Claim 17 further including a third cam surface and a fourth cam surface, each of said first, second, third and fourth cam surfaces having a different cam profile.

21. The cam of Claim 20 wherein said cam is mountable in any of four orientations, each of said four orientations selecting a different one of said first, second, third and fourth cam surfaces.



Fig-2

SUBSTITUTE SHEET (RULE 26)

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/98/14094

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 6 H01H23/00

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 H01H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3 944 768 A (ARYAMANE AVINASH ET AL) 16 March 1976 see abstract; claims; figures ---	1-21
A	US 3 684 850 A (KADERBEK CHARLES J ET AL) 15 August 1972 see the whole document ---	1-21
A	US 3 571 545 A (HADERER EDWARD G) 23 March 1971 see abstract; claims; figures ---	1-21
A	DE 26 36 632 A (SIEMENS AG) 16 February 1978 see the whole document ---	1-21
-/--		

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

\* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance  
 "E" earlier document but published on or after the international filing date  
 "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)  
 "O" document referring to an oral disclosure, use, exhibition or other means  
 "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention  
 "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone  
 "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.  
 "&" document member of the same patent family

Date of the actual completion of the international search

16 October 1998

Date of mailing of the international search report

23/10/1998

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
 NL - 2280 HV Rijswijk  
 Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
 Fax: (+31-70) 340-3016

Authorized officer

Durand, F



# INTERNATIONAL SEARCH REPORT

International Application No

PCT/JP83/14094

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3 118 031 A (EUGENE F. DUNCAN) 14 January 1964 see the whole document ---	1-21
A	US 3 852 552 A (FUJII H ET AL) 3 December 1974 see abstract; claims; figures -----	1-21

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/98/14094

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 3944768	A	16-03-1976	NONE	
US 3684850	A	15-08-1972	NONE	
US 3571545	A	23-03-1971	DE 1957118 A FR 2023197 A GB 1259527 A	11-06-1970 07-08-1970 05-01-1972
DE 2636632	A	16-02-1978	NONE	
US 3118031	A	14-01-1964	GB 971267 A	
US 3852552	A	03-12-1974	NONE	